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megaspore mother cell as two megasporangia. This is a surprising conception of the megaspore, for it would mean that a megaspore (and presumably a microspore) could be formed with only one of the reduction divisions, that is, the megaspore would be completely formed at the close of the heterotypic mitosis. Cytologists will hardly accept such an interpretation.

The angiosperm embryo sac is interpreted as consisting of micropylar and an antipodal archegonium. This is another view which can hardly be accepted by one who has followed the gradual reduction of the female gametophyte from the bryophytes to the spermatophytes.

The book brings together an immense amount of material and will be useful just as an encyclopedia is useful. In such voluminous publications originality is not to be expected. There is a general index and an index of plant names. Many references to literature are given in the text, but the complete bibliography will be deferred until the work is complete.—CHARLES J. CHAMBERLAIN.

MINOR NOTICES

Forestry in Indiana.—The annual report of the Indiana State Board of Forestry² for the past year contains two papers of more than usual interest. The shorter, by STANLEY COULTER, contains a valuable mass of data on the rate of growth of various native tree species found upon the state reservation. Its study should make the selection of the best species for forest planting an easier matter, while at the same time it serves to emphasize the importance of conserving what has been the product of centuries of plant activity.

The longer article, by C. C. DEAM, the secretary of the board, is an illustrated descriptive list of the tree species native to the state and occupies 270 pages of the report. Excellent botanical descriptions of some 125 species are supplemented by full-page drawings of leaves and fruit, together with notes upon the economic uses and horticultural value of the trees, making it a valuable handbook of the forests of the state.—GEO. D. FULLER.

NOTES FOR STUDENTS

Recent work among gymnosperms.—STILES³ has investigated some material of *Podocarpus*, *Dacrydium*, and *Microcachrys*, and has made it the basis of a synthetic presentation of the classification, morphology, history, and phylogenetic connections of the group. The bringing together of this wealth of details in an organized form will serve the very useful purpose not only of suggesting genetic connections but also of indicating the important gaps in our knowledge. The general features of the group are summarized clearly and compactly under the categories of vegetative organs, spore-producing

² Eleventh annual report of Indiana State Board of Forestry for the year 1911. pp. 372. pls. 133. Indianapolis: Wm. B. Burford. 1912.

³ STILES, WALTER, The Podocarpeae. Ann. Botany 26:443-514. figs. 8. pls. 46-48. 1912.

members, and gametophytes. The most interesting feature of every such review of all the available knowledge in reference to a group is the conclusion as to its phylogenetic connections. In this case it is said that "the Podocarpeae are probably related to the Araucarieae, and, though to a much less extent, to the Abietineae." These connections have certainly long been obvious, as well as the absence of any evidence of a close connection with the Taxeae. The following statement, however, is not so obvious: "A consideration of the available evidence shows that there is much to be said for the view that regards the Coniferales as descendants of paleozoic lycopodialean ancestors." Much may be said for this view, but none of it seems convincing.

GIBBS⁴ has studied the development of the "female strobilus" of *Podocarpus*, a structure that certainly needs elucidation. It seems that the difficulties of interpretation disappear when the early stages of the strobilus are studied, thus eliminating the confusion of secondary modifications. Such a study "strikingly reveals the relationship of the axis to the strobilus or cone of Abietineae and its component parts." This includes the conclusion that the "ovuliferous envelope" of the podocarps is the equivalent of the ovuliferous scale of the Abietineae, which fuses "more and more till finally it merges in the ovular integument in *Torreya* and *Cephalotaxus*." The reduction in the strobilus organization is traced from Abietineae, through *Microcachrys* and *Dacrydium*, until it reaches its extreme expression in *Podocarpus*, in which genus, therefore, we are dealing with a much modified cone. Many details of structure are given which add materially to our knowledge of this interesting genus.

STILES⁵ published a brief note on the gametophytes of *Dacrydium* before the appearance of his comprehensive paper on the podocarps noted above. The details given emphasize the resemblance of the male gametophyte to those of *Podocarpus* and *Phyllocladus*, and the closer resemblance of the female gametophyte to that of *Phyllocladus* than to that of *Podocarpus*. It is becoming increasingly evident that *Phyllocladus* is a podocarp rather than a taxad.

Miss DUTHIE⁶ has investigated the anatomy of *Gnetum africanum*, a climbing species. Details are given of the structure of xylem, phloem, pith, medullary rays, cortex, latex tubes, epidermis of stem, cork, and leaves.

PEARSON⁷ has investigated three species of *Gnetum* (*G. scandens*, *G. africanum*, and *G. Buchholzianum*), the study of the microsporangium and

⁴ GIBBS, L. S., On the development of the female strobilus in *Podocarpus*. Ann. Botany **26**: 515-571. pls. 49-53. 1912.

⁵ STILES, WALTER, A note on the gametophytes of *Dacrydium*. New Phytol. **10**: 342-347. figs. 4. 1911.

⁶ DUTHIE, AUGUSTA V., Anatomy of *Gnetum africanum*. Ann. Botany **26**: 593-602. pls. 57-59. 1912.

⁷ PEARSON, H. H. W., On the microsporangium and microspore of *Gnetum*, with some notes on the structure of the inflorescence. Ann. Botany **26**: 603-620. figs. 6. pls. 60, 61. 1912.

microspore being chiefly those of *G. africanum*. The inflorescence is described and also the details of spermatogenesis from the mother cell to the microspore, the reduced number of chromosomes being 12. Great interest attaches to the male gametophyte of *Gnetum*, but the present account does not clear it up. At pollination, three free nuclei were observed in the pollen grain, which "are probably to be identified as one prothallial, one vegetative (tube), and one generative." Since Lotsy has figured three free nuclei in the pollen tube of *Gnetum Gnemon*, which were obviously a tube nucleus and two male cells, the free "prothallial nucleus" in the pollen grain is open to doubt. One would like to be sure whether *Gnetum* has eliminated prothallial tissue or not. The author says that "the germination of the microspore and the structure of the pollen grain point to a much closer degree of affinity with *Welwitschia* than with *Ephedra*," a conclusion which all other structures confirm.

Miss GORDON⁸ has discovered ray tracheids, both marginal and interspersed, in old stem wood of *Sequoia sempervirens*. Since the wood of this form is primitive enough in features to suggest its comparison with root wood, the presence of ray tracheids is especially interesting.

WIELAND⁹ has published an interesting account of *Williamsonia*, a genus which he has done so much to elucidate. A few years ago a problematical genus, it has now emerged clearly as a prominent Mesozoic group. An account is given of its discovery, its structure, and its phylogenetic connections. Its great range in habit, its variations in the structure of the strobilus, its variable foliage, all suggest wide relationships, and among these suggested relationships WIELAND sees emphasized his contention that the angiosperms have been derived from the Bennettitales.

The same author,¹⁰ in continuing his studies on the trunks of *Cycadeoidea*, has discovered that some of the supposed young strobili are mature ones of reduced type. This incidentally disturbs some of the previous conclusions as to relationships among the species of *Cycadeoidea*, and especially extends our knowledge as to the range of variation in the structure of the strobilus. These reduced or simplified forms of course are more suggestive of the structure of the angiosperm flower.—J. M. C.

Inheritance of doubleness in stocks.—Doubleness in stocks (*Matthiola*) presents one of the most complicated cases of inheritance yet thoroughly studied, but Miss SAUNDERS¹¹ has developed a scheme which allows a consistent

⁸ GORDON, MARJORIE, Ray tracheids in *Sequoia sempervirens*. New Phytol. **11:1-7.** figs. 7. 1912.

⁹ WIELAND, G. R., On the Williamsonian tribe. Amer. Jour. Sci. **32:433-466.** figs. 18. 1911.

¹⁰ WIELAND, G. R., A study of some American fossil cycads. Part VI. On the smaller flower-buds of *Cycadeoidea*. Amer. Jour. Sci. **33:73-91.** figs. 11. 1912.

¹¹ SAUNDERS, Miss E. R., Further experiments on the inheritance of "doubleness" and other characters in stocks. Jour. Genetics **1:393-376.** pls. 2. figs. 2. 1911.